09/926132
518 Rec'd PCT/PTO 07 SEP 2001

Process for manufacturing a silicone part intended to be adhesively bonded and self-adhesive assembly manufactured according to the process

The invention relates to any molded part, made of silicone, intended to be mounted by adhesive bonding on a substrate, for example in order to constitute a seal.

It is known that silicone parts can be adhesively bonded only with a silicone-based adhesive, the latter adhering to the silicone part only if it cures after having been brought into contact with the part.

It is known practise to use silicone molded parts as seals, blocking joints, dampers, stops, etc.

It is known practise either to premold the part and then bond it to its substrate or to overmold the part directly onto its substrate.

In the case of premolding the part followed by adhesive bonding, a layer of silicone adhesive is deposited on the substrate at that point where the silicone molded part must be placed, the molded part is then positioned and time must elapse for the adhesive to cure. This bonding process has several drawbacks: the cure time of the adhesive is long; a specific tool for positioning the part is required and this tool is tied up while the curing takes place; and there is the difficulty of having an adhesive layer which is uniform in thickness and does not spill over.

In the case of overmolding, a thin silicone adhesive layer, or more precisely an adhesion primer, is deposited on the substrate at the point where the silicone molded part must be located. This layer is then left to dry for a time varying from about a quarter of an hour to about three quarters of an hour, depending on its composition and the ambient

temperature. A mold whose hollow cavity corresponds to the silicone part covers the adhesive-coated portion and silicone resin is injected into the mold. After the resin has cured, the mold is removed. This bonding process also has drawbacks: time must be allowed for the adhesion primer layer to dry; and an even longer time must be allowed for the curing to take place, during which time the tied-up mold cannot be used elsewhere; and this is a mold which is often complex and expensive.

It is an object of the present invention to avoid, or at the very least to reduce, these drawbacks by providing a manufacturing process which results in a self-adhesive assembly.

The invention relates to a process for manufacturing a silicone molded part intended to be fastened to another part by adhesive bonding, said silicone part being, at the end of the process, in the form of a self-adhesive assembly, characterized in that it comprises at least the following steps:

* using a mold having a hollow cavity, the dimensions of which are approximately equal to those of the self-adhesive assembly;
* using adhesive bonding means consisting of a stack comprising, in succession, at least a protective sheet, a layer of a first adhesive, an intermediate sheet and a layer of a second adhesive, said second adhesive being silicone-based;
* placing said adhesion means in said mold, the protective sheet being in contact with one of the walls of the hollow cavity;
* injecting a silicone resin into the space left free inside the mold by said adhesion means; and
* curing the self-adhesive assembly, formed from the adhesion means and the silicone resin, and then demolding it.

The invention also relates to a self-adhesive assembly comprising at least one part intended to be fastened to another part and double-sided adhesive bonding means made from a stack comprising, in succession, a protective sheet, a layer of a first adhesive, an intermediate sheet and a layer of a second adhesive in contact with the part to be bonded, characterized in that the part to be adhesively bonded is a silicone part and in that the second adhesive is silicone-based.

The invention will be more clearly understood and further features will become apparent from the following description and from figure 1, appended hereto, which shows, seen in cross section, means used in the process.

To allow a silicone part to be rapidly bonded to another part without tieing for a long period the positioning equipment used during industrial-scale manufacture, it is proposed below to produce self-adhesive assemblies in which the silicone part is combined with a double-sided self-adhesive strip during its molding.

Since molding techniques are assumed to be known to the reader, certain details such as the resin injection into a mold or the retention of a sheet against the internal wall of a mold by suction, will be mentioned without going into the implementation details.

The silicone parts produced according to the process may either be parts molded directly to the desired dimensions or sheets designed to be cut subsequently to the desired dimensions.

Figure 1 shows, in cross-sectional view, a self-adhesive assembly and a mold M used to manufacture the self-adhesive assembly.

The mold M is formed from two half-shells M1, M2 which, when they are joined together, as shown in the figure, constitute a cavity with, on the inside, a space bounded by "the hollow cavity" (E_1, E_2) of the mold. The dimensions of the hollow cavity correspond approximately to the dimensions of the self-adhesive assembly to be obtained.

The self-adhesive assembly, as shown in the figure, consists of a stack comprising, in succession, a protective sheet Fp, a layer Ce of a first adhesive, an intermediate sheet Fi, a layer Cs of a second adhesive and the part R made of silicone resin.

The manufacturing process consists, after having produced the mold M, in obtaining the double-sided adhesive, Ce + Fi + Cs, with its protective sheet Fp. The adhesive of the layer Cs is a substance compatible with silicone, that is to say a silicone-based adhesive. The substances used in the process are chosen to be compatible with the mechanical, thermal, chemical and other properties of the desired self-adhesive assembly. The illustrative example serving for the present description will be commented upon in greater detail below.

During one step of the process, the double-sided adhesive (Ce + Fi + Cs) is placed in the half-mold M1 with the protective sheet Fp in contact with the bottom F1 of the cavity E_1. The dimensions of the cavity E_1 of the half-shell M1 correspond approximately to the dimensions of the assembly consisting of the double-sided adhesive and the protective sheet Fp. That side of the layer Cs furthest away from the bottom F1 is approximately flush with that face of the half-shell M1 which is contact with the half-shell M2.

The half-shell M1 is drilled with several suction ducts (not shown in the figure). These are, as is

conventional in the art of molding, very fine holes which pass through the half-shell M1 and emerge in the bottom F1 of the hollow cavity E_1 where the protective sheet Fp lies. These holes make it possible, by suction using a pump (not shown), to keep the double-sided adhesive and the protective sheet in place.

When the double-sided adhesive Ce + Fi + Cs is in place, the half-shell M2 is brought against the half-shell M1 with their hollow cavities (E_1, E_2 respectively) facing each other, as shown in the drawing. The two half-shells are kept in position by fastening means (not shown) known to those skilled in the art.

The half-shell M2 is drilled with several injection holes (not shown in the figure). These are, here again as is conventional in the art of molding, a number of holes, some of which are used to inject the material to be molded, in this case silicone resin, and the rest of which are used to allow the air contained in the hollow cavity to escape as it becomes progressively filled with the material to be molded.

During a subsequent step, the mold is filled with resin, the assembly is subjected to a curing step and, once the resin has cured, the self-adhesive assembly, comprising the double-sided adhesive, the protective sheet and the silicone resin part, is demolded. This self-adhesive assembly is either ready to be used or ready to be cut to the desired dimensions. To do this, all that is required is to remove the protective sheet Fp in order to be able to position it without any complex tooling and without a waiting time during manufacture, given that the self-adhesive assembly is "ready to stick", unlike, as mentioned previously, silicone parts whose adhesive bonding means are joined to the part only at the moment of bonding.

In the example described, as shown in the figure, the width l_1 of the hollow cavity E_1 of the half-shell M1 is greater than the width l_2 of the hollow cavity E_2 of half-shell M2; this makes it possible, in addition to holding the double-sided adhesive in place by suction, to hold it in place by jamming along its edges.

Again in the case of the example described, the mold M is made of aluminum, a material compatible with silicone, that is to say a material for which there is no problem of any chemical reaction, particularly while the silicone resin is curing. Choosing a compatible material is a manufacturing precaution well known to those skilled in the art of manufacturing molded silicone parts.

The transverse dimensions of the half-molds M1 and M2, namely the width l_M and its height H_M are 15 cm by 3 cm, respectively.

The protective sheet Fp and the layer of a first adhesive Ce consist of an adhesive film produced and sold by 3M under the reference VHB 9460; this is an adhesive of constant thickness backed by a protective sheet made of siliconzied paper.

The intermediate sheet Fi and the layer of a second adhesive Cs consist of an adhesive film produced by Protectia under the reference KAPTON 830; this is a KAPTON film coated on one side with a silicone-based adhesive bonding element. It should be noted that the VHB 9460 film is not silicone-based but, as evident from the above, only the layer Cs needs to be made of a silicone-based adhesive, it being understood that the adhesive of the layer Ce needs to adhere to the sheet Fi.

The present invention is not limited to the foregoing; it is possible for the double-sided adhesive to be held

in place in the mold by, for example, lightly bonding it instead of holding it in place by suction.

Likewise, the transverse dimensions of the cavities of the half-shells M1, M2 may be the same along the parting line of these half-shells, or indeed that of the half-shell M2 may be greater than that of the half-shell M1.

With regard to the parting lines between M1 and M2 on the one hand and between R and Cs on the other hand, these may be at different levels; thus, for example, the half-shell M1 may be a simple plate and the assembly R + Cs + Fi + Ce + Fp is then entirely housed in the cavity of the half-shell M2, the dimensions and the geometry of which are chosen accordingly.

With regard to the various constituents, these will, of course, have to be chosen according to the part to be produced and according to the conditions under which this part is stored and used.